

Applicants : Patrick Gane, Matthias Buri and Beat Karth
Appl. No. : Not Yet Assigned (National Stage of PCT/IB2003/005063)
Filed : Herewith

Amendments to the Claims:

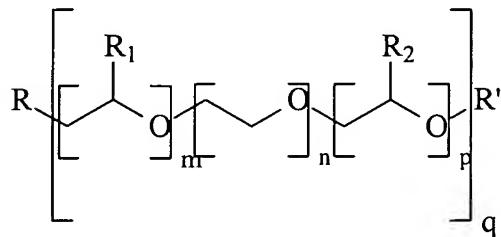
A complete listing of the claims, including Claims 3-5, 7-12, 15, 16, 19, 21 and 24-33 as currently amended, is set forth below:

1- (Original) An aqueous suspension of refined mineral matter with dry matter concentration that can be high, with low Brookfield™ that remains stable over time, and having a pigmentary surface area with low ionic charge, characterized in that it contains, as a grinding aid agent, a copolymer consisting of:

a) at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,

b) at least one non-ionic ethylenically unsaturated monomer of formula (I):

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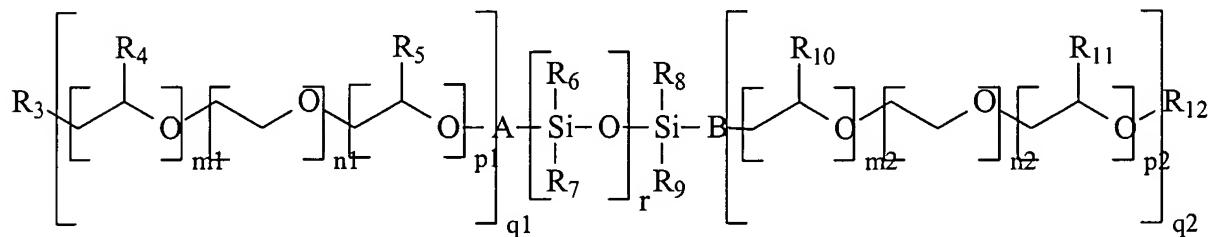
where

- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,
- R_1 represents hydrogen or the methyl or ethyl radical
- R_2 represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12 carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

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c) at least one organofluorinated or organosilylated monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof: with formula (IIa)



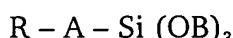
where

- m_1, p_1, m_2 and p_2 represent a number of alkylene oxide units less than or equal to 150
- n_1 and n_2 represent a number of ethylene oxide units less than or equal to 150
- q_1 and q_2 represent an integer equal to at least 1 and such that $0 \leq (m_1+n_1+p_1)q_1 \leq 150$ and $0 \leq (m_2+n_2+p_2)q_2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R_3 represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_4, R_5, R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical

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- R_6, R_7, R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms
- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

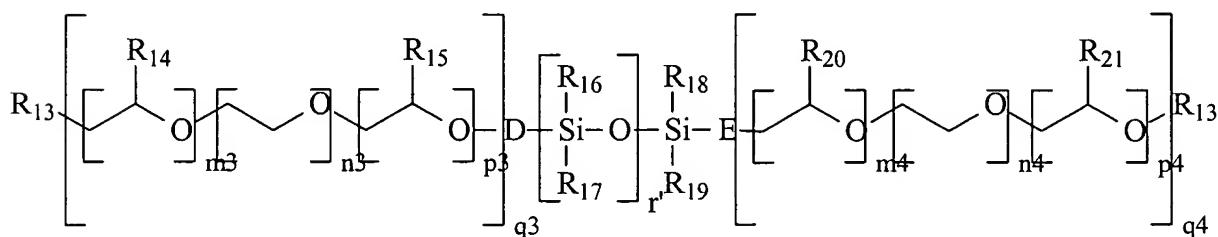
with formula (IIb)



where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIc)



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where

- m3, p3, m4 and p4 represent a number of alkylene oxide units less than or equal to 150
- n3 and n4 represent a number of ethylene oxide units less than or equal to 150
- q3 and q4 represent an integer equal to at least 1 and such that $0 \leq (m3+n3+p3)q3 \leq 150$ and $0 \leq (m4+n4+p4)q4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,
- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14} , R_{15} , R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16} , R_{17} , R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

d) possibly at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-

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(dimethylamino) ethyl] acrylate or mixtures thereof, vinyls such as vinyl acetate, vinylpyrrolidone, styrene, alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof

e) possibly at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetrallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%,

and having an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

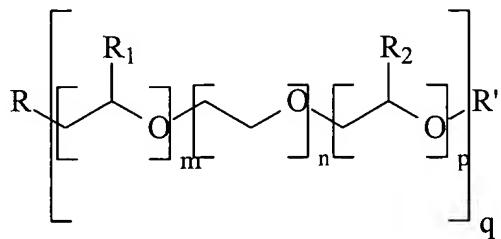
2- (Original) An aqueous suspension of mineral substances refined according to claim 1 characterized in that said copolymer consists, by weight, of:

a) from 2% to 95%, preferably from 3% to 25%, and even more preferably from 4% to 15%, of at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or

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having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,

b) From 97.9% to 4.9%, preferably from 95% to 65%, and even more preferably from 92% to 78%, of at least one non-ionic ethylenically unsaturated monomer of formula (I):



where

- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,

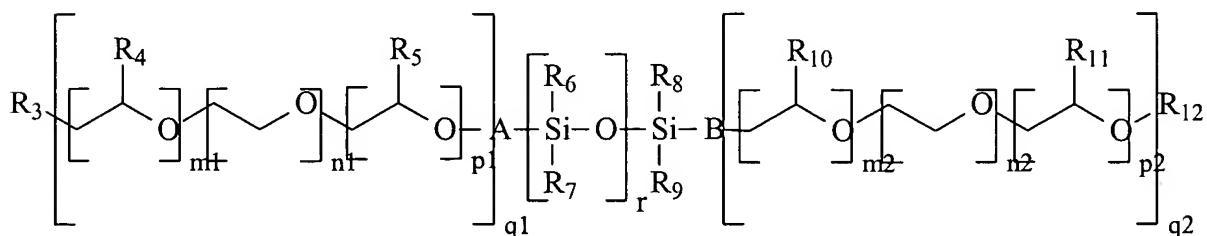
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- R_1 represents hydrogen or the methyl or ethyl radical
- R_2 represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12 carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

c) from 0.1% to 50%, preferably from 0.2% to 10%, and even more preferably from 0.3% to 5%, of at least one organofluorinated or organosilylated monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof:

with formula (IIa)

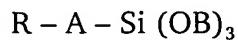


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where

- m_1, p_1, m_2 and p_2 represent a number of alkylene oxide units less than or equal to 150
- n_1 and n_2 represent a number of ethylene oxide units less than or equal to 150
- q_1 and q_2 represent an integer equal to at least 1 and such that $0 \leq (m_1+n_1+p_1)q_1 \leq 150$ and $0 \leq (m_2+n_2+p_2)q_2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R_3 represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_4, R_5, R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical
- R_6, R_7, R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms
- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIb)

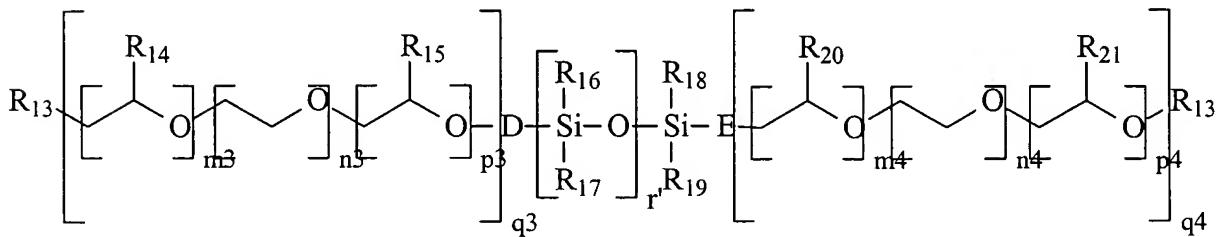


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where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIc)



where

- m3, p3, m4 and p4 represent a number of alkylene oxide units less than or equal to 150
- n3 and n4 represent a number of ethylene oxide units less than or equal to 150
- q3 and q4 represent an integer equal to at least 1 and such that $0 \leq (m3+n3+p3)q3 \leq 150$ and $0 \leq (m4+n4+p4)q4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,

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- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14} , R_{15} , R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16} , R_{17} , R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

d) from 0% to 50%, preferably from 0% to 10%, and even more preferably from 0% to 5%, of at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-(dimethylamino) ethyl] acrylate or mixtures thereof, vinyls such as vinyl acetate, vinylpyrrolidone, styrene, alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof

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e) from 0% to 5%, and preferably from 0% to 3%, of at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetrallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%, and in that said copolymer has an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

3- (Currently Amended) An aqueous suspension of mineral matter according to claim 1 or 2, characterized in that said copolymer is in its acid form, fully neutralized or partially neutralized by one or more neutralizing agents having a monovalent neutralizing function or a polyvalent neutralizing function such as, for the monovalent function, those selected from among the group consisting of the alkaline cations, in particular sodium, potassium, lithium, ammonium or the primary, secondary or tertiary aliphatic and/or cyclic amines such as stearylamine, the ethanolamines (mono-, di-, triethanolamine), mono and diethylamine, cyclohexylamine, methylcyclohexylamine, aminomethylpropanol, morpholine or, for the polyvalent function, those selected from among the group consisting of alkaline earth divalent cations, in particular magnesium and calcium, or zinc, and of the trivalent cations, including in particular aluminium, or of certain cations of higher valency.

4- (Currently Amended) An aqueous suspension of mineral matter according to one of claims 1 to 3, characterized in that it contains from 0.05% to 10% of said copolymer by dry weight with respect to the dry weight of mineral substances.

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5- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 to 3, characterized in that it contains from 0.05% to 10% of said copolymer by dry weight with respect to the dry weight of mineral substances and at least one other dispersant or grinding aid agent.

6- (Original) An aqueous suspension of mineral matter according to claim 5, characterized in that the other dispersant or grinding aid agent is selected from among the dispersants or grinding aid agents such as the homopolymers or copolymers of acrylic acid in their acid form, or fully or partially neutralized by one or more neutralizing agents having a monovalent neutralizing function or a polyvalent neutralizing function such as, for the monovalent function, those selected from among the group consisting of the alkaline cations, in particular sodium, potassium, lithium, ammonium or the primary, secondary or tertiary aliphatic and/or cyclic amines such as stearylamine, the ethanolamines (mono-, di-, triethanolamine), mono and diethylamine, cyclohexylamine, methylcyclohexylamine, aminomethylpropanol, morpholine or, for the polyvalent function, those selected from among the group consisting of alkaline earth divalent cations, in particular magnesium and calcium, or zinc, and of the trivalent cations, including in particular aluminium, or of certain cations of higher valency, or selected from among the dispersants or grinding aid agents such as the H_3O^+ ion donors preferably selected from among phosphoric acid and/or its salts with mono and/or divalent bases such as soda and lime.

7- (Currently Amended) An aqueous suspension of mineral matter according to claim 5 or 6, characterized in that it contains from 0.05% to 1.0% by dry weight with respect to the dry weight of mineral substances of said other dispersant or grinding aid agent.

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8- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 ~~to~~ 7, characterized in that the mineral matter is selected from among calcium carbonate, dolomite, gypsum, calcium hydroxide, satin white, titanium dioxide, aluminium trihydroxide, mica, talc, kaolins, calcine kaolins, or mixed carbonate based fillers of various metals such as calcium associated with magnesium, and mixtures of said fillers such as talc-calcium carbonate or calcium carbonate-kaolin mixtures, or mixtures of calcium carbonate with aluminium trihydroxide, or mixtures with synthetic or natural fibres or co-structures of minerals such as talc-calcium carbonate or talc-titanium dioxide co-structures, and is preferably calcium carbonate such as natural calcium carbonate selected from among marble, calcite, chalk or mixtures thereof.

9- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 ~~to~~ 8, characterized in that the suspension has a dry matter concentration of between 15% and 85% by weight, preferably between 40% and 80%, and very preferably between 50% and 78%.

10- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 ~~to~~ 9, characterized in that the mineral matter presents a median grain diameter, as measured using the Sedigraph™ 5100, of between 50 μm and 0.01 μm , preferably between 5 μm and 0.2 μm and even more preferably between 2 μm and 0.3 μm .

11- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 ~~to~~ 10, characterized in that the mineral matter grains have, for equivalent grain size, a BET specific surface area determined according to standard ISO 9277 less than that of the mineral matter grains of the aqueous suspensions of mineral matter refined using grinding aid agents such as polyacrylates, homopolymers or copolymers.

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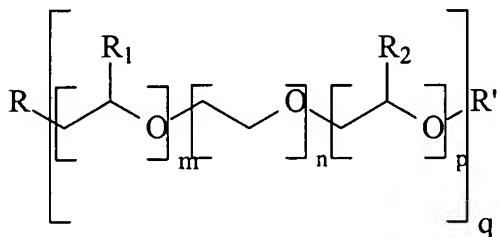
12- (Currently Amended) An aqueous suspension of mineral matter according to ~~one of~~ claims 1 to 11, characterized in that the pH of the final suspension is between 7.5 and 13, preferably between 8 and 12 and very preferably between 8.5 and 10.

13- (Original) The use as a grinding aid agent for mineral matter in aqueous suspension of a weakly ionic and water-soluble copolymer is characterized in that said copolymer consists of:

a) at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,

b) at least one non-ionic ethylenically unsaturated monomer of formula (I):

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where

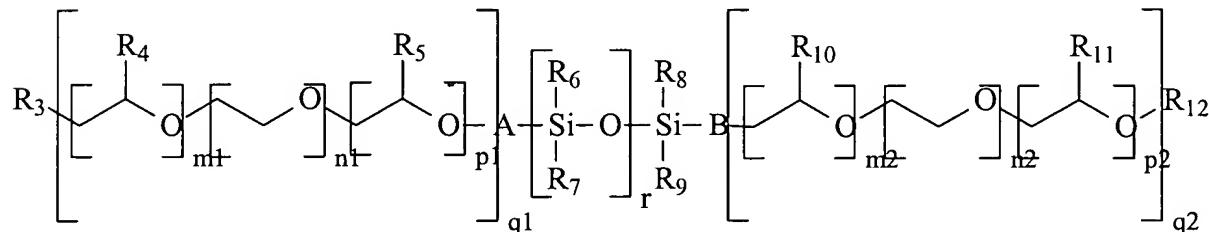
- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,
- R_1 represents hydrogen or the methyl or ethyl radical
- R_2 represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12 carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

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c) at least one organofluorinated or carbon silicon derivative monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof:

with formula (IIa)



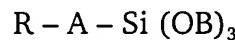
where

- m1, p1, m2 and p2 represent a number of alkylene oxide units less than or equal to 150
- n1 and n2 represent a number of ethylene oxide units less than or equal to 150
- q1 and q2 represent an integer equal to at least 1 and such that $0 \leq (m1+n1+p1)q1 \leq 150$ and $0 \leq (m2+n2+p2)q2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R₃ represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,

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- R_4 , R_5 , R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical
- R_6 , R_7 , R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms
- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIb)

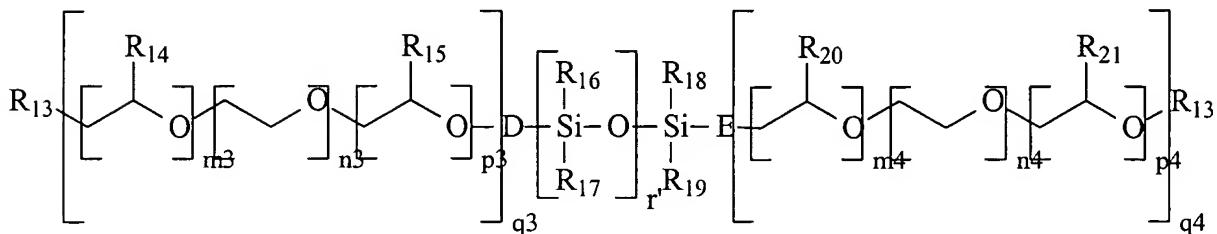


where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIc)

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where

- m3, p3, m4 and p4 represent a number of alkylene oxide units less than or equal to 150
- n3 and n4 represent a number of ethylene oxide units less than or equal to 150
- q3 and q4 represent an integer equal to at least 1 and such that $0 \leq (m3+n3+p3)q3 \leq 150$ and $0 \leq (m4+n4+p4)q4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,
- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14} , R_{15} , R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16} , R_{17} , R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

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d) possibly at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-(dimethylamino) ethyl] acrylate or mixtures thereof, vinyls such as vinyl acetate, vinylpyrrolidone, styrene, alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof

e) possibly at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetrallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%,

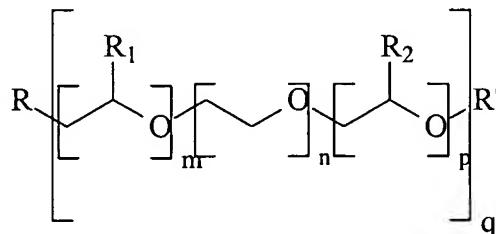
and in that said copolymer has an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

14- (Original) The use of a weakly ionic and water-soluble copolymer as a grinding aid agent according to claim 13, characterized in that said copolymer consists, by weight, of:

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a) from 2% to 95%, preferably from 3% to 25%, and even more preferably from 4% to 15%, of at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,

b) From 97.9% to 4.9%, preferably from 95% to 65%, and even more preferably from 92% to 78%, of at least one non-ionic ethylenically unsaturated monomer of formula (I):



where

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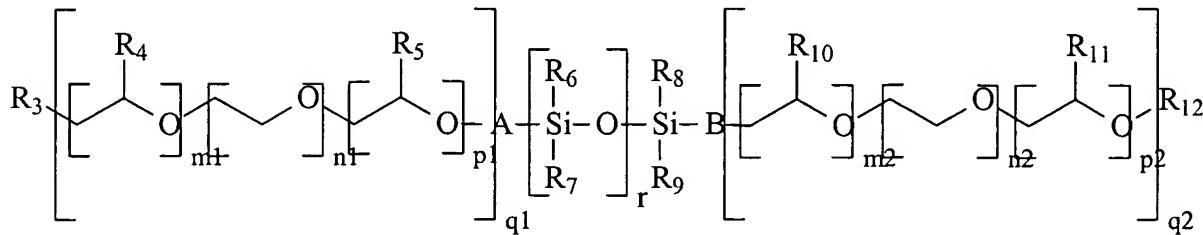
- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,
- R_1 represents hydrogen or the methyl or ethyl radical
- R_2 represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphtalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12 carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

c) from 0.1% to 50%, preferably from 0.2% to 10%, and even more preferably from 0.3% to 5%, of at least one organofluorinated or organosilylated monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof:

with formula (IIa)

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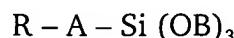
where

- m_1, p_1, m_2 and p_2 represent a number of alkylene oxide units less than or equal to 150
- n_1 and n_2 represent a number of ethylene oxide units less than or equal to 150
- q_1 and q_2 represent an integer equal to at least 1 and such that $0 \leq (m_1+n_1+p_1)q_1 \leq 150$ and $0 \leq (m_2+n_2+p_2)q_2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R_3 represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_4, R_5, R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical
- R_6, R_7, R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms

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- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

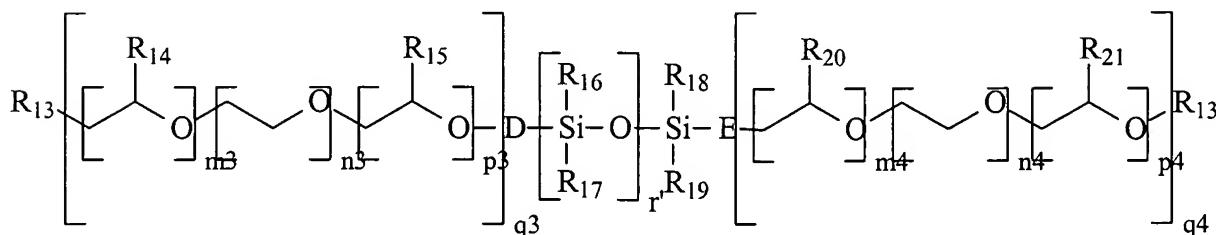
with formula (IIb)



where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIc)



where

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- m3, p3, m4 and p4 represent a number of alkylene oxide units less than or equal to 150
- n3 and n4 represent a number of ethylene oxide units less than or equal to 150
- q3 and q4 represent an integer equal to at least 1 and such that $0 \leq (m3+n3+p3)q3 \leq 150$ and $0 \leq (m4+n4+p4)q4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,
- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14} , R_{15} , R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16} , R_{17} , R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

d) from 0% to 50%, preferably from 0% to 10%, and even more preferably from 0% to 5%, of at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-(dimethylamino) ethyl] acrylate, vinyls such as vinyl acetate, vinylpyrrolidone, styrene,

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alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof

e) from 0% to 5%, and preferably from 0% to 3%, of at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetraallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%,

and in that said copolymer has an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

15- (Currently Amended) The use of a weakly ionic and water-soluble copolymer according to ~~any one of~~ claims 13 to 14, characterized in that said copolymer obtained in acid form and possibly distilled can also be fully or partially neutralized by one or more neutralizing agents having a monovalent neutralizing function or having a polyvalent neutralizing function such as, for the monovalent function, those selected from among the group consisting of the alkaline cations, in particular sodium, potassium, lithium, ammonium or the primary, secondary or tertiary aliphatic and/or cyclic amines such as stearylamine, the ethanolamines (mono-, di-, triethanolamine), mono and diethylamine, cyclohexylamine, methylcyclohexylamine, aminomethylpropanol, morpholine or, for the

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polyvalent function, those selected from among the group consisting of alkaline earth divalent cations, in particular magnesium and calcium, or zinc, and of the trivalent cations, including in particular aluminium, or of certain cations of higher valency.

16- (Currently Amended) The use of a weakly ionic and water-soluble copolymer according to ~~any one of~~ claims 13 to 14, characterized in that said copolymer obtained from the copolymerization reaction may, before or after the total or partial neutralization reaction, be treated and separated into several phases, according to statistical or dynamic processes, by one or more polar solvents belonging to the group consisting of water, methanol, ethanol, propanol, isopropanol, butanols, acetone, tetrahydrofuran or mixtures thereof.

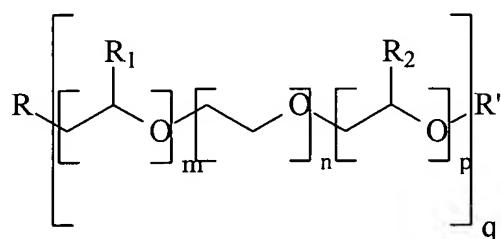
17- (Original) A grinding aid agent for mineral matter in aqueous suspension, characterized in that said agent is a copolymer consisting of:

a) at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol

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methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,

b) at least one non-ionic ethylenically unsaturated monomer of formula (I):



where

- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,
- R₁ represents hydrogen or the methyl or ethyl radical
- R₂ represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12

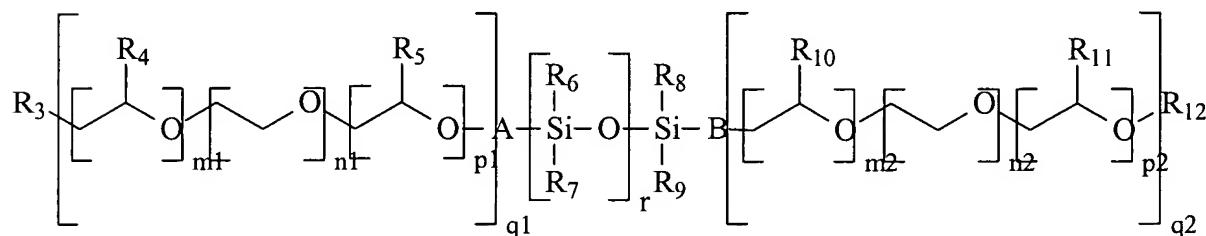
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carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

c) at least one organofluorinated or organosilylated monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof:

with formula (IIa)



where

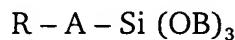
- m1, p1, m2 and p2 represent a number of alkylene oxide units less than or equal to 150
- n1 and n2 represent a number of ethylene oxide units less than or equal to 150
- q1 and q2 represent an integer equal to at least 1 and such that $0 \leq (m1+n1+p1)q1 \leq 150$ and $0 \leq (m2+n2+p2)q2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R₃ represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-

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isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,

- R_4 , R_5 , R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical
- R_6 , R_7 , R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms
- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIb)

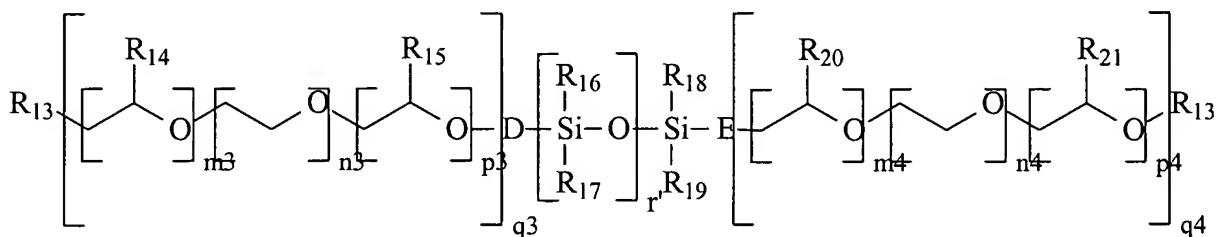


where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

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with formula (IIc)



where

- m_3, p_3, m_4 and p_4 represent a number of alkylene oxide units less than or equal to 150
- n_3 and n_4 represent a number of ethylene oxide units less than or equal to 150
- q_3 and q_4 represent an integer equal to at least 1 and such that $0 \leq (m_3+n_3+p_3)q_3 \leq 150$ and $0 \leq (m_4+n_4+p_4)q_4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,
- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14}, R_{15}, R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16}, R_{17}, R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof

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- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,
- d) possibly at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-(dimethylamino) ethyl] acrylate or mixtures thereof, vinyls such as vinyl acetate, vinylpyrrolidone, styrene, alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof
- e) possibly at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetrallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%,

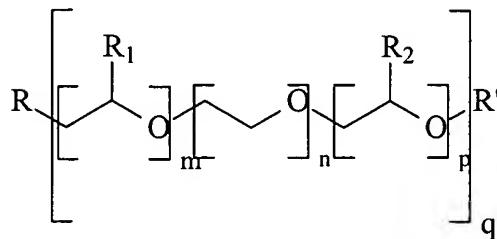
and having an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

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18- (Original) A grinding aid agent for mineral matter in aqueous suspension according to claim 17, characterized in that said agent is a copolymer consisting, by weight, of:

- a) from 2% to 95%, preferably from 3% to 25%, and even more preferably from 4% to 15%, of at least one ethylenically unsaturated anionic monomer having a monocarboxyl function selected from among the ethylenically unsaturated monomers having a monocarboxyl function such as acrylic or methacrylic acid or hemiesters of diacids such as C₁ to C₄ monoesters of maleic or itaconic acid, or mixtures thereof, or having a dicarboxyl function selected from among the ethylenically unsaturated monomers having a dicarboxyl function such as crotonic, isocrotonic, cinnamic, itaconic, maleic acid, or anhydrides of carboxyl acids, such as maleic anhydride or having a sulfonic function selected from among the ethylenically unsaturated monomers having a sulfonic function such as acrylamido-methyl-propane-sulfonic acid, sodium methallylsulfonate, vinylsulfonic acid and styrenesulfonic acid or having a phosphoric function selected from among the ethylenically unsaturated monomers having a phosphoric function such as vinylphosphoric acid, ethylene glycol methacrylate phosphate, propylene glycol methacrylate phosphate, ethylene glycol acrylate phosphate, propylene glycol acrylate phosphate and their ethoxylates or having a phosphonic function selected from among the ethylenically unsaturated monomers having a phosphonic function such as vinylphosphonic acid, or mixtures thereof,
- b) From 97.9% to 4.9%, preferably from 95% to 65%, and even more preferably from 92% to 78%, of at least one non-ionic ethylenically unsaturated monomer of formula (I):

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where

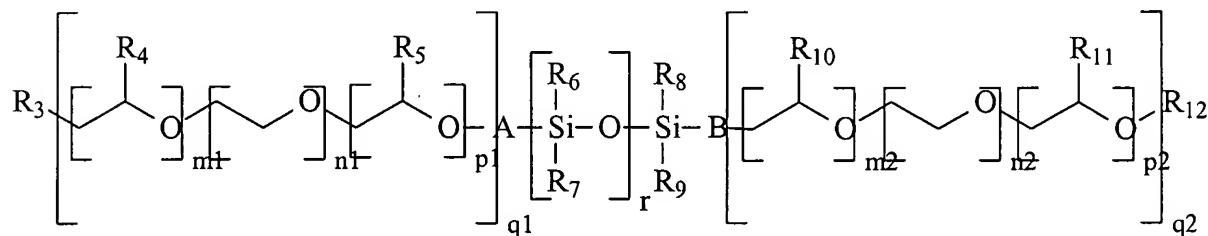
- m and p represent a number of alkylene oxide units less than or equal to 150
- n represents a number of ethylene oxide units less than or equal to 150
- q represents an integer equal to at least 1 and such that $5 \leq (m+n+p)q \leq 150$, and preferably represents an integer such that $15 \leq (m+n+p)q \leq 120$,
- R_1 represents hydrogen or the methyl or ethyl radical
- R_2 represents hydrogen or the methyl or ethyl radical
- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R' represents hydrogen or a hydrocarbon radical having from 1 to 40 carbon atoms, and preferably represents a hydrocarbon radical having from 1 to 12 carbon atoms and even more preferably a hydrocarbon radical having from 1 to 4 carbon atoms,

or a mixture of several monomers of formula (I),

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c) from 0.1% to 50%, preferably from 0.2% to 10%, and even more preferably from 0.3% to 5%, of at least one organofluorinated or organosilylated monomer, preferably selected from among the molecules of formulae (IIa) or (IIb) or (IIc) or mixtures thereof:

with formula (IIa)



where

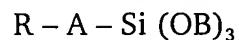
- m1, p1, m2 and p2 represent a number of alkylene oxide units less than or equal to 150
- n1 and n2 represent a number of ethylene oxide units less than or equal to 150
- q1 and q2 represent an integer equal to at least 1 and such that $0 \leq (m1+n1+p1)q1 \leq 150$ and $0 \leq (m2+n2+p2)q2 \leq 150$,
- r represents a number such that $1 \leq r \leq 200$
- R₃ represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl

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ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,

- R_4 , R_5 , R_{10} and R_{11} represent hydrogen or the methyl or ethyl radical
- R_6 , R_7 , R_8 and R_9 represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof
- R_{12} represents a hydrocarbon radical having from 1 to 40 carbon atoms
- A and B are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms,

with formula (IIb)

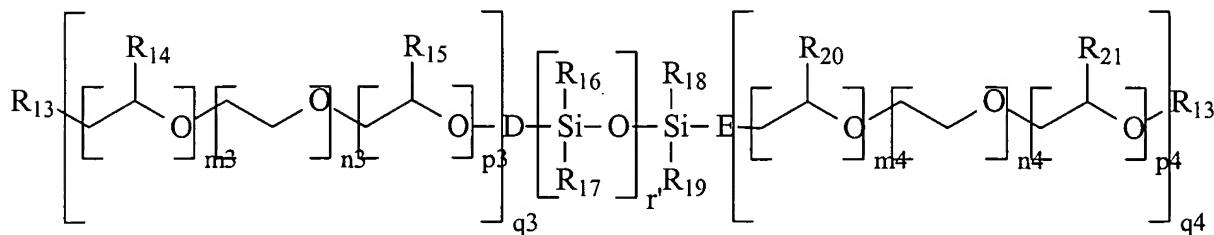


where

- R represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- A is a group which may be present, in which case it represents a hydrocarbon radical having from 1 to 4 carbon atoms,
- B represents a hydrocarbon radical having from 1 to 4 carbon atoms,

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with formula (IIc)



where

- m_3, p_3, m_4 and p_4 represent a number of alkylene oxide units less than or equal to 150
- n_3 and n_4 represent a number of ethylene oxide units less than or equal to 150
- q_3 and q_4 represent an integer equal to at least 1 and such that $0 \leq (m_3+n_3+p_3)q_3 \leq 150$ and $0 \leq (m_4+n_4+p_4)q_4 \leq 150$,
- r' represents a number such that $1 \leq r' \leq 200$,
- R_{13} represents a radical containing a polymerizable unsaturated function, belonging to the vinyl group and to the group of acrylic, methacrylic, maleic, itaconic, crotonic, and vinylphthalic esters and to the group of urethane unsaturates such as acrylurethane, methacrylurethane, α - α' dimethyl-isopropenyl-benzylurethane and allylurethane, and to the group of allyl or vinyl ethers, whether or not substituted, or to the group of ethylenically unsaturated amides or imides,
- R_{14}, R_{15}, R_{20} and R_{21} represent hydrogen or the methyl or ethyl radical
- R_{16}, R_{17}, R_{18} and R_{19} represent straight or branched alkyl, aryl, alkylaryl or arylalkyl groups having from 1 to 20 carbon atoms, or a mixture thereof

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- D and E are groups which may be present, in which case they represent a hydrocarbon radical having from 1 to 4 carbon atoms
- d) from 0% to 50%, preferably from 0% to 10%, and even more preferably from 0% to 5%, of at least one monomer of the acrylamide or methacrylamide type or their derivatives or mixtures thereof such as N-[3-(dimethylamino) propyl] acrylamide or N-[3-(dimethylamino) propyl] methacrylamide, and mixtures thereof, or at least one non water-soluble monomer such as the alkyl acrylates or methacrylates or mixtures thereof, unsaturated esters such as N-[2-(dimethylamino) ethyl] methacrylate, or N-[2-(dimethylamino) ethyl] acrylate or mixtures thereof, vinyls such as vinyl acetate, vinylpyrrolidone, styrene, alphamethylstyrene and their derivatives or mixtures thereof, or at least one cationic monomer or quaternary ammonium such as [2-(methacryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [2-(acryloyloxy) ethyl] trimethyl ammonium chloride or sulphate, [3-(acrylamido) propyl] trimethyl ammonium chloride or sulphate, dimethyl diallyl ammonium chloride or sulphate, [3-(methacrylamido) propyl] trimethyl ammonium chloride or sulphate, or mixtures thereof
- e) from 0% to 5%, and preferably from 0% to 3%, of at least one crosslinking monomer selected from the group consisting of ethylene glycol dimethacrylate, trimethylolpropanetriacrylate, allyl acrylate, the allyl maleates, methylene-bis-acrylamide, methylene-bis-methacrylamide, tetrallyloxyethane, triallylcyanurates, allyl ethers prepared from polyols such as pentaerythritol, sorbitol, or sucrose

the total of the components a), b), c), d) and e) being equal to 100%,

and having an intrinsic viscosity less than or equal to 100 ml/g determined in accordance with the method known as the intrinsic viscosity method.

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19- (Currently Amended) A grinding aid agent for mineral matter in aqueous suspension according to ~~any one of~~ claims 17 or 18 characterized in that said agent is a copolymer in its acid form or fully neutralized or partially neutralized by one or more neutralizing agents having a monovalent neutralizing function or a polyvalent neutralizing function such as, for the monovalent function, those selected from among the group consisting of the alkaline cations, in particular sodium, potassium, lithium, ammonium or the primary, secondary or tertiary aliphatic and/or cyclic amines such as stearylamine, the ethanolamines (mono-, di-, triethanolamine), mono and diethylamine, cyclohexylamine, methylcyclohexylamine, aminomethylpropanol, morpholine or, for the polyvalent function, those selected from among the group consisting of alkaline earth divalent cations, in particular magnesium and calcium, or zinc, and of the trivalent cations, including in particular aluminium, or of certain cations of higher valency.

20- (Original) A grinding aid agent for mineral matter in aqueous suspension according to claim 19, characterized in that said copolymer obtained from the copolymerization reaction may, before or after the total or partial neutralization reaction, be treated and separated into several phases, according to statistical or dynamic processes, by one or more polar solvents belonging to the group consisting of water, methanol, ethanol, propanol, isopropanol, butanols, acetone, tetrahydrofuran or mixtures thereof.

21- (Currently Amended) A process for grinding mineral matter in aqueous suspension consisting of refining an aqueous suspension of said mineral materials into very fine particles characterized in that use is made, as a grinding aid agent before and/or during the grinding stage, of 0.05% to 10% by dry weight, with respect to the dry weight of mineral matter, of the copolymer according to ~~any one of~~ claims 16 to 20, and in that use may be made of at least one other dispersant or grinding aid agent before and/or during the grinding stage.

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22- (Original) A grinding process in aqueous suspension according to claim 21, characterized in that said other dispersant or grinding aid agent is selected from among the dispersants or grinding aid agents such as homopolymers or copolymers of acrylic acid in their acid forms, or fully or partially neutralized by one or more neutralizing agents or selected from among the dispersants or grinding aid agents such as H₃O⁺ ion donors preferably selected from among phosphoric acid and/or its salts with mono and/or divalent bases such as soda or lime.

23- (Original) A grinding process in aqueous suspension according to claim 22, characterized in that use is made of 0.05% to 1.0%, by dry weight with respect to the dry weight of mineral substances, of said other dispersant or grinding aid agent.

24- (Currently Amended) A grinding process in aqueous suspension according to ~~any one~~ of claims 21 to 23, characterized in that the temperature during the course of the grinding stage and for all the variants of the grinding process according to the invention is between 15°C and 150°C, preferably between 50°C and 105°C and very preferably between 60°C and 98°C.

25- (Currently Amended) A grinding process in aqueous suspension according to ~~any one~~ of claims 21 to 24, characterized in that, for mineral matter containing carbonate, the pH during the course of the grinding stage lies between 6 and 13, preferably between 7.5 and 12 and very preferably between 8 and 10.

26- (Currently Amended) A grinding process in aqueous suspension according to ~~any one~~ of claims 21 to 24, characterized in that, for mineral matter not containing carbonate, the pH during the course of the grinding stage lies between 2 and 13, preferably between 7.5 and 12 and very preferably between 8 and 10.

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27- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~any one of~~ claims 1 to 12 in the field of paper, paint and plastics.

28- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~any one of~~ claims 1 to 12 before or after drying or re-dispersion after drying in the field of paper and paint, and after drying in the field of plastics.

29- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~any one of~~ claims 1 to 12 in a drying process after grinding.

30- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~any one of~~ claims 27 to 29 in the paper industry and more particularly use for coating the paper and/or for the surface treatment of the paper.

31- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~any one of~~ claims 27 to 29 in the paper industry and more particularly use as direct filler during the manufacture of the paper, board, or analogous sheets or as indirect filler during manufacture of the paper, board, or analogous sheets implementing recycling of the coating brokes.

32- (Currently Amended) Paper or board sheets containing the aqueous suspension of mineral matter according to ~~any one of~~ claims 1 to 12.

33- (Currently Amended) The use of the aqueous suspension of mineral matter according to ~~one of~~ claims 27 to 29 in the field of plastic such as low density (LLDPE) and high density (HMW-HDPE) polyolefines, or breathable membranes, or polyvinyl chlorides (PVC) and more particularly in the field of PVCs such as rigid or flexible PVCs.